Eutardigrada: Distribution at Eniwetok Atoll, Marshall Islands[1]

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ABSTRACT: Six species of Eutardigrada were found at Eniwetok Atoll, representing two families (Macrobiotidae and Milnesiidae) and three genera (*Hypsibius, Macrobiotus,* and *Milnesium*). *Hypsibius* (*Calohypsibius*) *truncatus* was found in sand samples from the thalassosupralittoral fringe at Runit and Eniwetok islets. *H.* (*Isohypsibius*) *augusti* was found in sand of the thalassosupralittoral fringe on Engebi Islet. *Macrobiotus allani* was found on Muti Islet; *M. harmsworthi* on Bogallua, Engebi, Roijoa, Eniwetok, Muti, and Igurin islets; *M. richtersi* on Japtan and Muti islets; all three species from tree-borne lichens and mosses. *Milnesium tardigradum* was commonly recovered from lichens and mosses on Muti and Igurin islets. The total number of individuals collected was small compared to collections in the temperate zone. No morphological anomalies were noted.

THE TARDIGRADE FAUNA of Micronesia has been neglected; the prime objective of this study, therefore, was to extend the range of collecting to provide more extensive data on tardigrade distribution, and the secondary objectives were to acquire specimens for long-term studies on comparative morphology, intraspecific variability, and life history.

METHODS

After a preliminary survey of the atoll, 11 islets were selected for study on the basis of accessibility by motorboat and of habitat diversity. These islets include those with topography severely, partially, or very slightly damaged during World War II, atomic bomb testing, or both of these destructive events. The native names of the islets follow the Decision List 4414 of the Board on Geographical Names and the code names used by the military are included in parentheses.

Sand, lichen, and moss samples were promptly brought to the laboratory on Eniwetok Islet and processed according to the methods of Mehlen (1969*a, b,* and in press). After being soaked overnight in tap water in beakers or petri dishes, the samples were squeezed out over a petri dish to recover the tardigrades, which were then killed and fixed by heating on an electric hot plate. Under examination with a binocular dissection microscope the animals were picked out with an Irwin loop and stored in vials of 70 percent ethanol prior to subsequent study as glycerol or lactophenol mounts.

DESCRIPTION OF SPECIES

Hypsibius (*Calohypsibius*) *truncatus* Thulin

Diagnosis

Cuticle unornamented. Body length small. Claws small; outer claw almost twice as large as inner claw; primary branch of outer claw twice as large as secondary branch. Gullet narrow, moderate in length. Apophyses large. Pharynx oval. Macroplacoids three in number, ovoid in shape; first shorter than second, third the longest. Microplacoid absent. Distance from stylet support to anterior margin of pharynx equal to half the gullet width.

Atoll Distribution

This species was occasionally recovered from sand samples taken at the supralittoral fringe on

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Runit Islet (site Yvonne) and Eniwetok Islet (site Fred). At Eniwetok Islet it was rarely accompanied by very small numbers of *Macrobiotus harmsworthi.*

Hypsibius (Isohypsibius) augusti Murray

Diagnosis

Cuticle unornamented. Body length small. Claws small. Ocelli anterior to furcae. Gullet narrow and moderate in length. Pharynx slightly oval. Macroplacoids three in number, rod-shaped; first slightly shorter than second, third the longest. Microplacoid absent. Distance from stylet supports to anterior margin of pharynx equal to about half the gullet width.

Atoll Distribution

This species was occasionally recovered from sand samples taken along the seaward supralittoral fringe on Engebi Islet (site Janet), being the only tardigrade in the samples.

Macrobiotus allani Murray

Diagnosis

Cuticle unornamented. Body length small. Claws moderate sized, secondary branch half as long as primary; lunule simple. Mouth with one mouth ring, lamellae present. Gullet narrow and short. Pharynx nearly round. Macroplacoids round, three in number. Microplacoid very small, located very close to third macroplacoid. Distance from stylet supports to anterior margin of pharynx about equal to three times the width of gullet.

Atoll Distribution

This species was rarely encountered in lichen samples from Muti Islet (site David), accompanied by numerous individuals of *Macrobiotus harmsworthi* and *Milnesium tardigradum.*

Macrobiotus harmsworthi Murray

Diagnosis

Cuticle unornamented. Body length small to moderate. Claws moderate sized, with lunule; primary branch with accessory spines. Mouth with two mouth rings, each with eight lamellae. Gullet moderate to wide, length tending to be about five times the width. Macroplacoids rod-shaped, three in number, relative lengths variable but third usually longest and second shortest, third often with slight terminal knob. Microplacoid large, located midway between third macroplacoid and posterior margin of pharynx, comma-shaped. Distance from stylet supports to anterior margin of pharynx equal to or slightly less than gullet width.

Atoll Distribution

This species was rarely recovered from the supralittoral fringe at Bogallua Islet (site Alice), Engebi Islet (site Janet), Roijoa Islet (site Ursula), and Eniwetok Islet (site Fred). On Muti Islet (site David) and Igurin Islet (site Glenn) it was commonly found in lichen, but at Igurin, in moss also.

Macrobiotus richtersi Murray

Diagnosis

Cuticle unornamented. Body length small to medium. Claw moderate size, with lunule, primary branch with accessory spines. Mouth with one mouth ring, lamellae present. Gullet moderately wide. Apophyses large. Macroplacoids rod-shaped, three in number, first and third nearly equal but second always shortest, third with terminal knob. Microplacoid small. Distance from stylet supports to anterior margin of pharynx about one-third the gullet width.

Atoll Distribution

This species was commonly collected from tree-borne lichens on Japtan Islet (site Bruce) and Muti Islet (site David).

Milnesium tardigradum Doyère

Diagnosis

Cuticle unornamented. Body length from small to large. Basal claw equal to or slightly shorter than the terminal claw; basal claw with one or two secondary branches, depending on instar. Gullet very wide, rather short; mouth surrounded by six oral papillae. Pharynx elongated, striated, without placoids. Stylets

small, somewhat arrow-shaped. Cephalic papillae located rather laterally, two in number.

Atoll Distribution

Found both in moss and lichen, this species was commonly recovered from Muti Islet (site David) and Igurin Islet (site Glenn).

DISCUSSION

With limited distribution and paucity of numbers compared to collections in the temperate zone, the genus *Hypsibius* was rather poorly represented. Yet it did appear as the dominant tardigrade of the thalassosupralittoral fringe and its presence there is surprising because eutardigrade distribution is, in general, halophobic. However, it may be significant to note that the only marine eutardigrade (*H. stenostomus*) is in this genus. The absence of *Hypsibius* from the lichens and mosses is as surprising as its appearance in the thalassosupralittoral fringe and neither is presently very well understood. *M. harmsworthi* was present in the thalassosupralittoral fringe only during the rainy period in autumn; when the trade winds became established in December, this species no longer was collected. The thalassosupralittoral fringe appeared to be a precarious place for the development of a tardigrade fauna, being subject to high-intensity tropical sunlight, salt spray, and variable salinity; dependent on the wind-driven spray and the rainfall; and possessing an unstable substratum because of wind and wave restructuring of the area. The fauna of this fringe appeared best developed during late summer and early autumn, which are periods of higher cloudiness and rainfall but lesser wind intensity.

In contrast to the thalassosupralittoral fringe, the lichen- and moss-associated faunas were composed of many genera, species, and individuals. The phytophilic tardigrades included: *Milnesium tardigradum, Macrobiotus allani, M. harmsworthi,* and *M. richtersi.* The distribution from islet to islet probably reflects nothing on tardigrade distribution characteristics per se but, rather, reflects the absence of mosses and lichens on most of the islets; mosses and lichens became more scarce the closer one came to the islets used during the testing of atomic weaponry. In spite of the potential genetic damage from the atomic testing, no morphological anomalies were noted in the tardigrades.

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